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PATENT SPECIFICATION

DRAWINGS ATTACHED

1,121,378

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COMPLETE SPECIFICATION

Improved Wall Box Seal Assembly for Heat Exchanger apparatus

We, DIAMOND POWER SPECIALTY CORPORATION, a Corporation organized and existing under the laws of the State of Ohio, United States of America, of U.S. Route 22, East Lancaster, Ohio, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to sealing devices and more particularly to an improved wall box seal assembly adapted for use in the walls of positive-pressure heat exchanger apparatus. More specifically, the wall box sealing assembly may be adapted to accommodate the lance tube of boiler cleaning apparatus such as retractable soot blowers.

In order to maintain optimum thermal efficiency of modern high capacity steam boilers, it is necessary to provide a plurality of cleaning apparatuses or soot blowers, as they are conventionally referred to, which are mounted exteriorly of the walls of the boiler and which are adapted to be periodically actuated for effecting a removal of soot, slag or other extraneous deposits from the heat exchanger surfaces. Soot blower apparatuses conventionally employed for such purposes comprise a retractable lance tube which is formed in the forward end portion thereof with one or more nozzles through which a pressurized cleaning medium such as steam or air, for example, is discharged and is effective upon impingement on the heat exchanger surfaces to effect a dislodgment of the slag deposits thereon. The lance tubes of such soot blowers during the period between cleaning cycles are normally disposed in an inoperative or retracted position in which the nozzle end portion thereof is retracted within the wall box so as to shield the lance tube from the hot combustion gases within the interior of the boiler. During the initiation of a cleaning cycle, the lance tube is projected from the inoperative position into the interior of the heat exchanger apparatus and conventionally is rotated during its translatory movement whereby the cleaning medium is discharged from the nozzles in the form of a helical blowing pattern.

Due to the increased size of modern high-capacity steam boilers, a substantial increase has occurred in the length of the lance tubes of long retracting type soot blowers in order to provide adequate coverage of the heat exchanger surfaces. Lance tubes of such increased length have been found to deflect due to the gravitational forces imposed thereon such that alignment problems are encountered between the peripheral surface of the lance tube and the wall box assembly through which the lance tube passes in aligned relationship therewith. The lance tube deflection has accordingly occasioned a problem of providing adequate sealing of the lance tube within the wall box to prevent inadvertent escape of the hot combustion gases from the interior of the boiler to the surrounding atmosphere.

In addition, wall box assemblies of the types heretofore known are of a rather cumbersome construction comprising a plurality of individual assembled components and conventionally incorporate two chambers formed with nozzles for alternatively discharging a sealing air when the lance tube is disposed in the wall box and an aspirating air for sealing the wall box when the lance tube is removed during periodic service of the soot blower. There has, accordingly, been a need for an improved wall box seal assembly which is of a simple construction and which provides adequate sealing of the lance tube and the wall box in spite of the deflection of the lance tube during the course of its travel into and out of the interior of a heat exchanger apparatus.

The principal object of the present invention is to provide an improved wall box seal assembly incorporating a floating seal member which is adapted to move and compensate for movement of the lance tube as the result of the

[*Price 4s. 6d.*]

deflection thereof during the course of its projecting and retracting travel maintaining an appropriate seal during all moved positions of the lance tube thereby preventing the escape of hot combustion gases from the interior of the boiler.

According to the invention there is provided a wall box seal assembly adapted for mounting on a port of a heat exchanger apparatus for providing access for a tubular element into the interior thereof, such seal assembly comprising a hollow housing including a pair of spaced-apart end walls formed with axially aligned ports therethrough; a plate slidably overlying the inner surface of the rearward one of the end walls and formed with an aperture therethrough having an annular edge adapted to be disposed in sliding sealing relationship around a tubular element; a collar including an annular wall having a diameter at its forward portion to encircle a tubular element and disposed with the rearward end thereof in sliding sealing relationship against the plate and with the forward end thereof in sliding sealing relationship against the inner surface of the other of the end walls, the collar, plate and housing defining in combination an internal chamber for encircling a tubular element extending through the assembly; and means for supplying a pressurized fluid to the chamber, said annular wall being formed with a plurality of circumferentially spaced nozzle apertures therethrough for discharging the pressurized fluid around a tubular element and toward the forward end of the collar.

A preferred embodiment of a wall box seal assembly later described in detail comprises a hollow housing including a pair of spaced-apart end walls formed with axially aligned ports therethrough for receiving a tubular cleaning element such as a lance tube which is adapted to extend therethrough. A plate is disposed in slidable overlying relationship against the inner surface of the rearward one of the end walls and is formed with an aperture therethrough having an annular edge adapted to be disposed in sliding sealing relationship around the lance tube. A collar which includes an annular wall preferably of a tapered construction and having a diameter at its forward end portion to encircle the lance tube is disposed between the plate and the inner surface of the other end wall in floating and sliding sealing relationship therebetween. The collar in combination with the plate and the housing define a chamber which is adapted to encircle the lance tube to which a pressurized fluid such as air, for example, is supplied and which in turn is discharged through a plurality of nozzles or ports disposed in circumferentially spaced relationship around the annular wall of the collar and is adapted to be discharged forwardly between the clearance gap formed by the collar and the lance tube. At such times when the lance tube is withdrawn from the wall port for periodic service and inspection, a higher pressure air is adapted to be supplied to the chamber which in turn is discharged in the form of a conical pattern forming an air screen or shield to prevent escape of combustion gases through the wall port to the exterior of the heat exchanger apparatus.

While the wall box seal assembly is described with particular applicability to soot blower apparatus, the present invention is equally applicable for sealing any one of a variety of cylindrical probes or cleaning elements which are adapted to be periodically inserted within the interior of a heat exchanger apparatus.

The present invention will be further described, merely by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a fragmentary side elevational view partly in section and partly schematic illustrating a wall box seal assembly constructed in accordance with a preferred embodiment of the present invention mounted exteriorly of a wall of a furnace;

Figure 2 is an enlarged longitudinal vertical sectional view of the wall box seal assembly as shown in Figure 1;

Figure 3 is an end elevational view of the outermost or rearward end of the wall box seal assembly shown in Figure 1;

Figure 4 is a elevational view of the inner or forward end of the wall box seal assembly shown in Figure 1; and

Figure 5 is a transverse vertical sectional view of the annular collar movably mounted within the wall box seal assembly as shown in Figure 2 and taken along the line 5—5 thereof.

Referring now in detail to the drawings and as may be best seen in Figure 1, a typical installation of a wall box seal assembly is illustrated including a furnace wall 10 having water wall tubes 12 mounted along the inner combustion side thereof and formed with a port or opening 14 in which a sleeve 16 is mounted. A housing 18 is rigidly secured such as by means of welding to the outer or rearward end of the sleeve 16, a lance tube 20 being adapted to extend through the sleeve 16. The lance tube 20, as shown in Figure 1, is in the inoperative or retracted position wherein a nozzle 22 in the forward end portion thereof is disposed within the protective confines of the housing 18. The nozzle 22 is adapted to discharge a suitable blowing medium during a cleaning cycle of the furnace. In this way, the lance tube and the nozzle therein are normally shielded from the hot combustion gases and radiant heat present within the interior of the furnace.

The housing 18 as best seen in Figures 1 and 2, is of a generally circular configuration and is formed as shown in Figure 3 with a pair of bosses 24 on the sides thereof in which

pivot pins 26 (Figure 1) are adapted to be disposed for pivotally securing the forward supporting framework of a soot blower indicated in phantom at 28 in Figure 1, whereby the lance tube 20 is maintained in appropriate axial alignment with the wall port. The housing 18 is formed along its lower portion with a threaded aperture 30, as best seen in Figure 2, into which a suitable supply pipe 32, as shown in Figure 1, is adapted to be connected for supplying a pressurized fluid to the interior of the housing.

The forward end portion or right hand side of the housing, as viewed in Figure 2, is formed with an inwardly extending end wall 34 having a port 36 therethrough which is of a size so as to provide for clearance between the edges thereof and the periphery of the lance tube 20. The lance tube 20 is shown in phantom in Figure 2 in a horizontal position as well as in a typical angularly deflected position. The inner surface of the end wall 34 is, as shown, preferably provided with an annular land 38 having a smoothly machined inner surface 40 which is adapted to be disposed in bearing sliding relationship against a forward surface 42 of an annular collar 44. To the rear or outer end portion of the housing 18, an annular cover plate 46 is removably secured such as by means of screws 48. A gasket 50 is disposed between the inner surface of the cover plate and the rearward edge of the housing 18 so as to form a substantially fluid-tight seal therebetween. The cover plate 46 is provided with a port 52 therethrough which is disposed in substantial axial alignment with the port 36 through the forward end wall of the housing and which is of a size substantially greater than the diameter of the lance tube adapted to extend therethrough. The inner surface of the cover plate 46 is preferably, as shown, formed with an annular land 54 having a smooth machined flat surface 56 against which the outer surface of a seal plate 58 is adapted to be disposed in sliding relationship.

The seal plate 58 is formed with an aperture 60 therethrough which is of a size slightly in excess of the diameter of a lance tube adapted to extend therethrough. The outer surface of the seal plate 58 is formed with an annular groove indicated at 62 which is adapted to receive an annular rib 64 of a seal ring 66 removably secured to the seal plate 58 by means of socket head screws 68. The seal ring 66 is formed with an annular rounded sealing edge 70 which is adapted to be disposed in close sliding and sealing relationship around the periphery of the lance tube 20. In accordance with a preferred embodiment of the present invention, the seal ring 66, as may be best seen in Figures 2 and 3, is comprised of a pair of semicircular segments which are adapted to be mounted on the seal plate 58 such that the adjacent ends 71 thereof are disposed in close substantial abutting relationship relative to each other defining therewith a substantially continuous annular sealing edge 70. The foregoing arrangement enables the seal ring 66 to be removed and replaced at such times as it becomes worn to an extent where an excessive escape of pressurized air passes between the sealing edge 70 and the periphery of the lance tube extending therethrough.

The annular collar 44, as best seen in Figures 2 and 5, is formed with an annular conically forwardly directed wall 72 which terminates at its forward end and defines a bore or sealing edge 74 of a diameter so as sealingly to encircle the periphery of the lance tube. The outer or rearward end of the annular wall 72 is provided with a smooth surface finish indicated at 76 which is adapted to be disposed in sliding sealing relationship against the inner surface of the seal plate 58.

A plurality of apertures extends through the annular wall 72 of the collar 44 and is disposed at substantially equal circumferentially spaced increments therearound, forming thereby a plurality of angularly oriented nozzles 78. The angular inclinations of the nozzles 78 are arranged so as to converge at a point corresponding substantially to the longitudinal axis of the bore through the collar at a point spaced forwardly therefrom as generally indicated at 80 in Figure 2.

In accordance with the foregoing arrangement, it will be apparent that the housing in combination with the cover plate 46, seal plate 58, seal ring 66, and annular collar 44 defines an internal chamber 82 which is adapted to encircle the lance tube extending through the wall box seal assembly. The pressurized fluid supplied through the supply pipe 32 to the interior of the chamber 82 serves to force the outer or rearward-most surface of the seal plate 58 against the flat surface 56 of the annular land 54 maintaining a substantially fluid-tight seal therebetween. At the same time, the fluid pressure within the chamber tends to force the forward surface 42 of the annular collar 44 against the seal surface 40 of the annular land 38, forming a substantially fluid-tight seal therebetween. Accordingly, the relatively close tolerance fit between the rearward end surface 76 of the collar and the inner surface of the seal plate, which is of a magnitude to permit relative sliding movement therebetween, produces a substantially fluid-tight seal thereby directing substantially all of the pressurized fluid out through the nozzles 78 and around the periphery of the lance tube. The pressurized air disposed between the sealing edge 70 of the seal ring 66 and the sealing edge 74 of the collar 44 is controlled so as to be at a pressure greater than that of the pressure within the interior of the furnace thereby preventing escape of the combustion gases from the interior of the furnace out through the wall box. The pressurized fluid discharged through the nozzle 78 escapes

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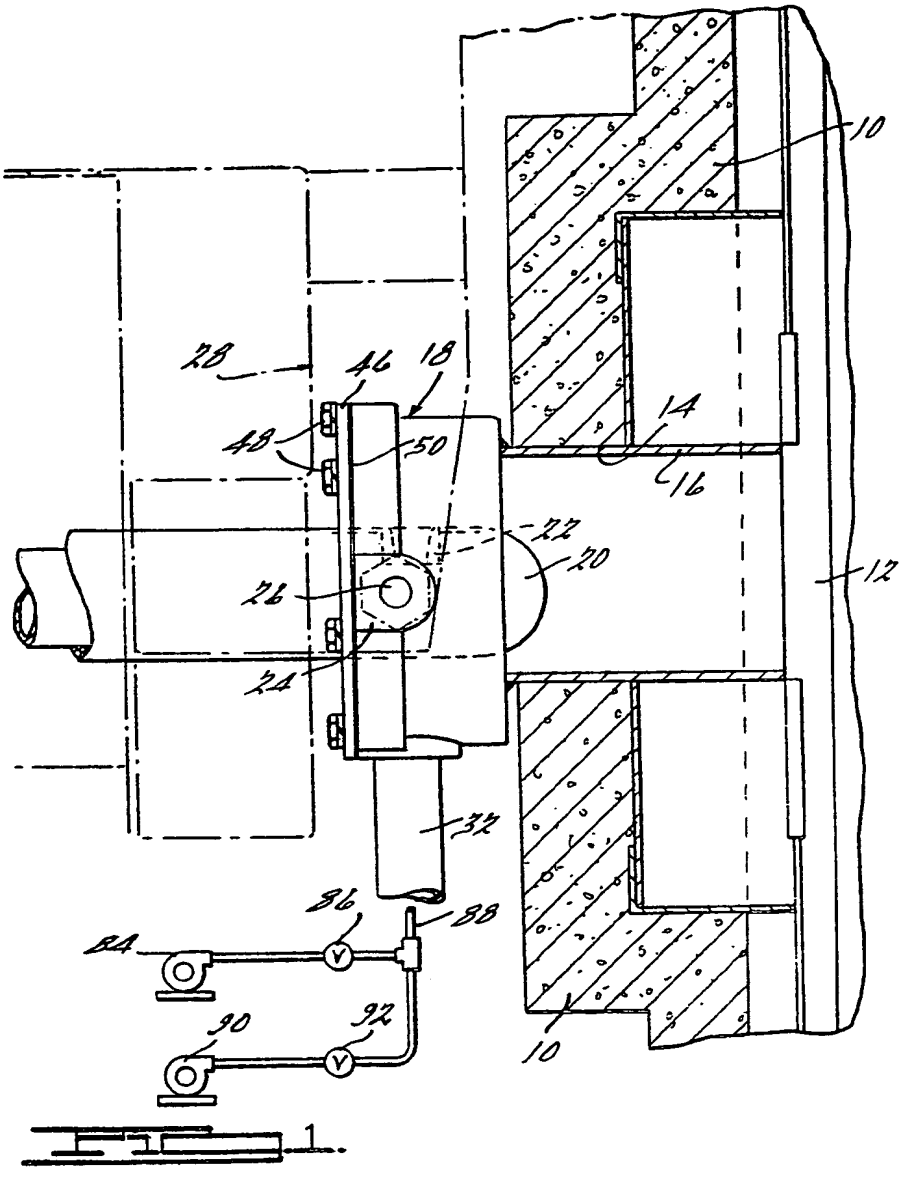
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1



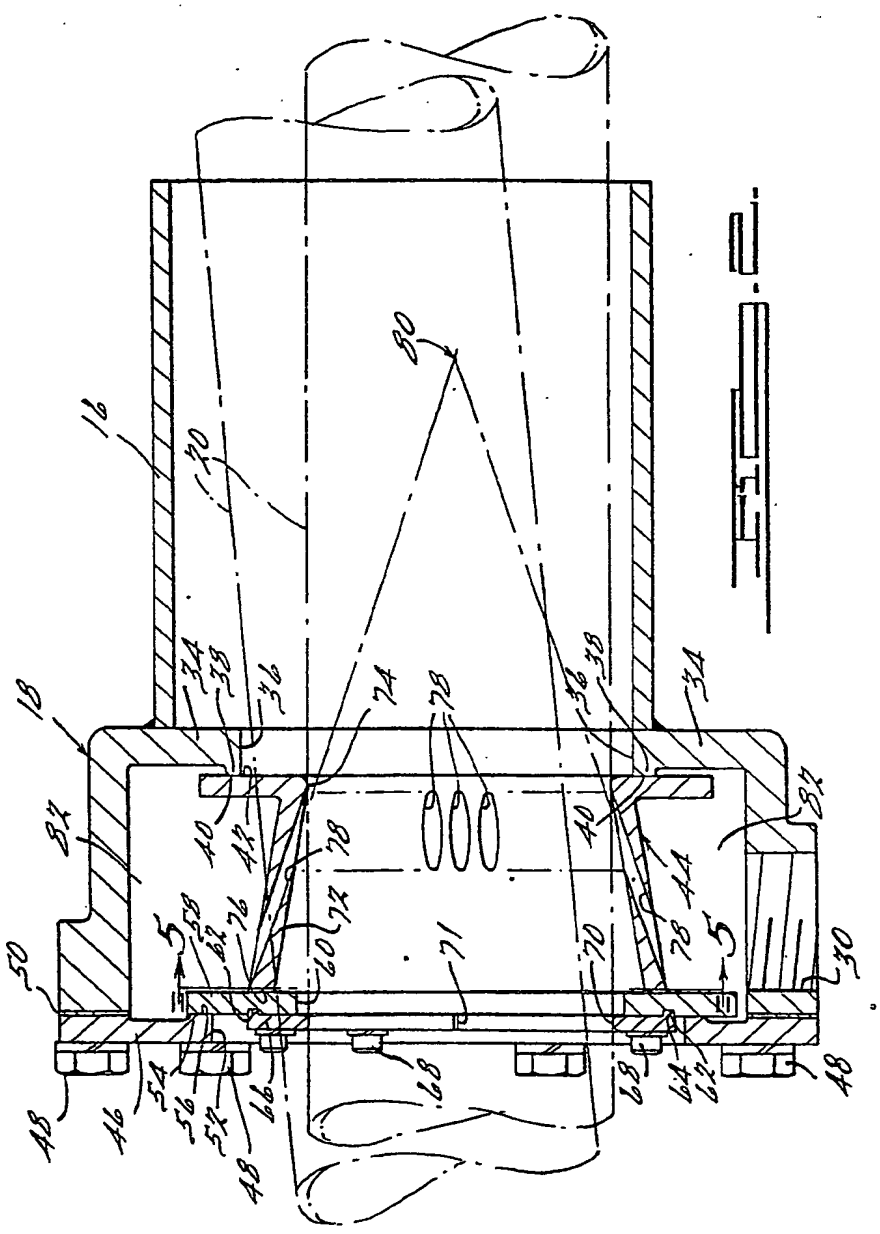


FIG. 2

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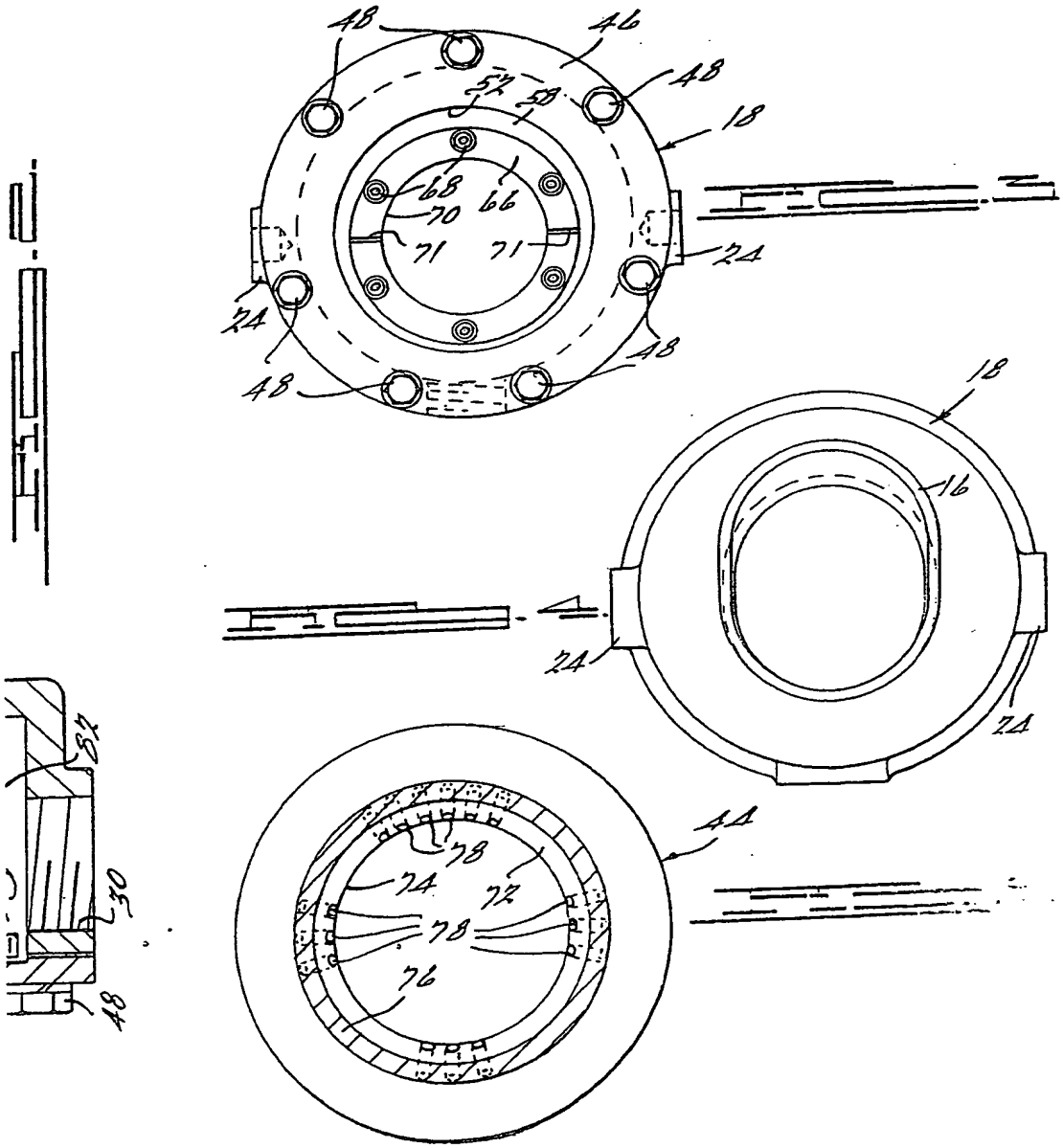
Sheets 2 & 3



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